

**Case study****Endovascular treatment for a femoral arteriovenous fistula  
after removal of a hemodialysis catheter: a case report****ABSTRACT**

Double-lumen catheters are commonly utilized to acquire temporary access for hemodialysis in patients suffering from acute renal failure. There are many complications related to catheter puncture. An AVF is rare but occasionally fatal. This case report presents a female patient, 49 years old with a post-catheterization AVF between the femoral common artery and femoral vein, which was successfully treated with a peripheral cover stent placement. A four-week clinical follow-up showed the patient's condition had significantly improved.

**ABBREVIATIONS**

**AVF:** Arteriovenous fistula; **HD:** Hemodialysis; **CT:** Computed tomography

**1. INTRODUCTION**

An arteriovenous fistula (AVF) is defined as an abnormal connection between an artery and a vein. Double-lumen catheters have been commonly utilized to acquire temporary access for hemodialysis in patients suffering from acute renal failure. Potential complications of catheter insertion include puncture site hemorrhage, pseudoaneurysm formation, vessel dissection, distal thrombosis, and arteriovenous fistulas formation. An iatrogenic AVF is a rare but severe complication, that can cause congestive cardiac failure and reduced circulation to the limbs. These days,

24 with the development of interventional procedures, covered stent placement with  
25 the endovascular technique for these lesions represents an appealing treatment  
26 alternative because it is not only minimally invasive but also requires less  
27 hospitalization and recovery time compared to open surgical repair. Herein, we  
28 present a female patient, 49 years old with a post-catheterization AVF between the  
29 femoral common artery and femoral vein, which was successfully treated with a  
30 peripheral cover stent placement. A four-week clinical follow-up showed the  
31 patient's condition had significantly improved.

## 32 **2. CASE PRESENTATION**

### 33 **2.1 Past Medical History**

34 A 49-year-old female patient with a 9-year history of chronic renal failure with  
35 periodic hemodialysis (HD), was admitted to a local hospital because of high fever  
36 and widespread infection in the right leg. 3 years prior, when unable to gain regular  
37 vascular access for hemodialysis, a double-lumen catheter was inserted into the  
38 right femoral vein to obtain temporary access to circulation for hemodialysis  
39 without ultrasound guidance. Two hours after completion of the first HD, a wide  
40 hematoma was observed around the puncture site. Three months after the catheter  
41 removal, she was readmitted to the local hospital because of right lower limb  
42 swelling and calf pain. At this hospital, she was confirmed to have a right femoral  
43 AVF and underwent an open surgery for vascular repair. Unfortunately, the  
44 operation was unsuccessful. One year later, the patient was admitted to the same  
45 hospital for arteriovenous fistula closure, but it failed and recorded the drop of the  
46 object as the Guide Wire in the common iliac vein to vena cava and right atrium.  
47 After this incident, the patient refused all future surgical proposals. 10 days ago,  
48 she had a fever, swelling and a lot of ulcers in the right leg. She was diagnosed

49 with sepsis and received active treatment with antibiotics. Once her condition was  
50 stabilized, she was transferred to the Cho Ray Hospital.

## 51 **2.2 Physical Findings**

52 - Vital signs: Pulse rate 92 beats per minute, body temperature 39 degrees C,  
53 respiratory rate 25 breaths per minute, blood pressure 120/90 mmHg

54 - The patient was fatigued, with pallor skin.

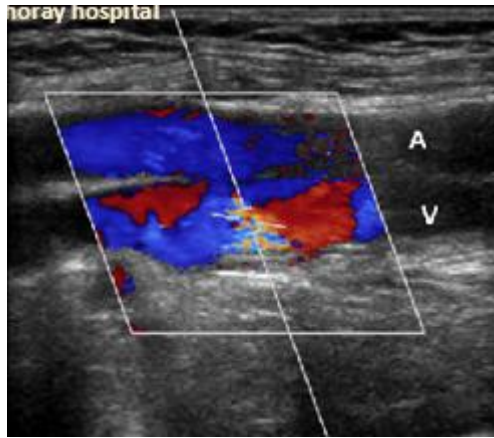
55 - Physical examination revealed swelling from the groin to the lower leg, cellulitis  
56 in the calf and ulcers of the toes. A bruit was heard on auscultation and a fluid  
57 thrill was felt at the right inguinal area. The leg circumference was compared with  
58 the unaffected side, as shown in Table 1.

59 *Table 1: the comparison between left and right leg circumference*

Position	Right leg	Left leg
Femoral circumference	83mm	42mm
Calf circumference	45mm	33mm

## 60 **2.3 Imaging Diagnosis**

61 - A Doppler ultrasound revealed an AVF between the right common femoral artery  
62 and the right femoral vein, with a hole of 4mm in diameter (Figure 1). In addition,  
63 the ultrasound findings also detected a hyperechoic rod-shaped structure in the  
64 common iliac vein extending to the vena cava.

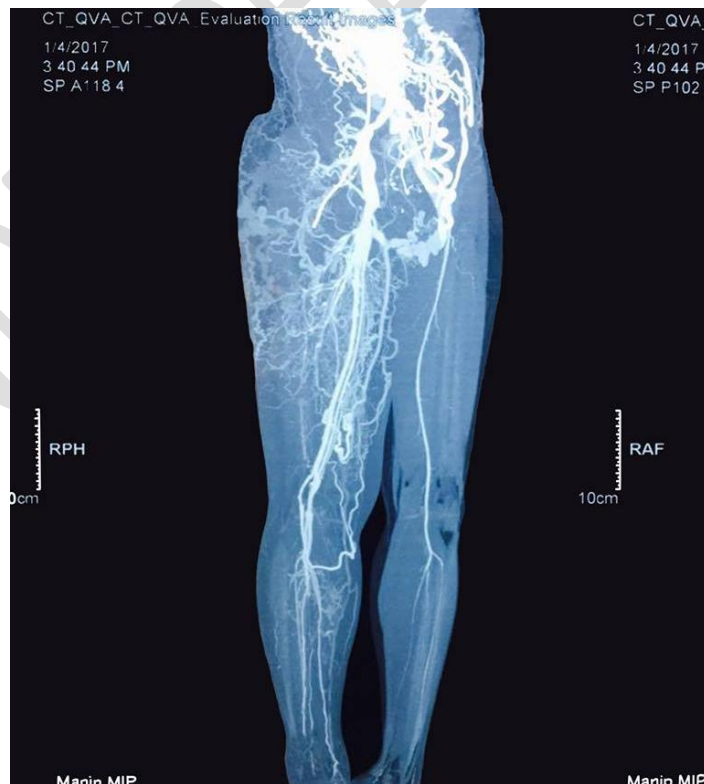


65

66 *Figure 1: Ultrasound findings showed a fistula between the common femoral*  
 67 *artery and the femoral vein.*

68 - Computed Tomography angiography detected an AVF between the right common  
 69 femoral artery and the right femoral vein, with dilated circulatory vessels around  
 70 the inguinal, and collateral circulation (Figure 2).

71



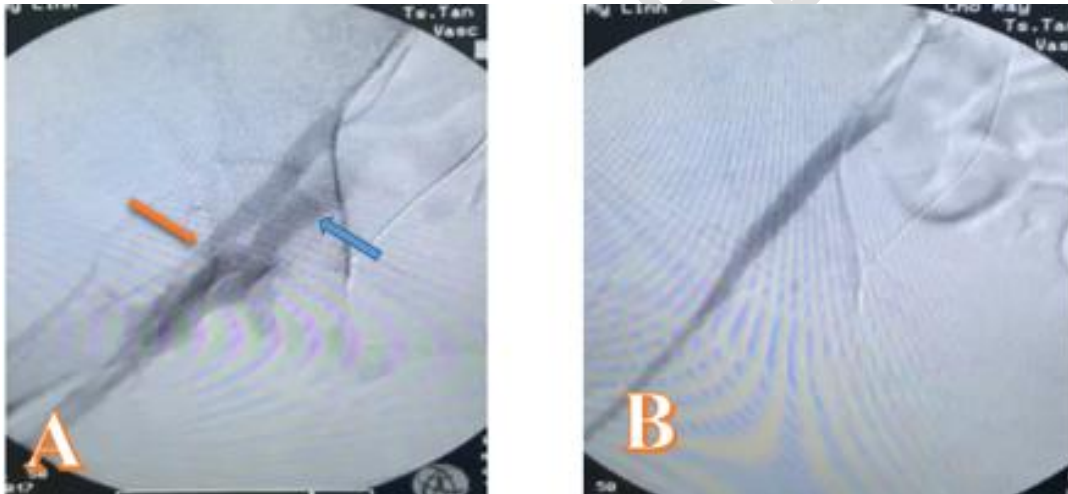
72

73

*Figure 2: CT angiography figure*

#### 74 **2.4 Treatment and follow up**

75 Given the severity of the patient's condition, he high risk of anesthesia and failure  
 76 in open surgery, we decided to insert a cover stent into the common femoral artery  
 77 to close the AVF under local anesthesia and the puncture site in the left femoral  
 78 artery, to avoid entering the infected area in the right groin. Under the guidance of  
 79 the vascular doppler ultrasound and CT angiography, we inserted a 10x10x80mm  
 80 cover stent from the common femoral artery through the fistula to the femoral  
 81 bifurcation. On the image after the intervention, it was clear that the AVF was  
 82 completely closed (Figure 3).



83

84 *Figure 3: The difference between before (A) and after (B) inserting the cover stent*

85 *Orange arrow: the fistula, Blue arrow arrow: femoral vein appeared straightway*  
 86 *after injecting contrast agent*

87 The patient was followed up in the vascular department before being transferred to  
 88 the internal department, and was discharged 9 days after the intervention. The  
 89 condition of the right leg improved, and the swelling decreased significantly (as  
 90 seen in Table 2 and Figure 4).

91 *Table 2: The change in circumference between 7 days and 21 days follow up.*

Position	7 days	21 days
Right femoral circumference	65mm	55mm
Calf circumference	38mm	31mm

92



93

94 *Figure 4: The leg condition pre-intervention (A), 1 week (B)*

95 *and 3 weeks (C) post- intervention.*

### 96 **3. DISCUSSION**

97 An AVF is an irregular connection between an artery and a vein, and the incidence  
 98 of post-catheterisation AVFs range from 0.006 to 0.86% [1]. AVF as a  
 99 complication of dual-lumen HD catheter insertion has been described in literature  
 100 around the world. Although it is rare, when it occurs it can cause complications  
 101 such as chronic limb swelling and high output cardiac failure [2] [3]. To reduce the  
 102 risk, ultrasound is recommended. Many reports indicate that ultrasound guidance is  
 103 superior to make a landmark, and ultrasound guidance is of particular value in  
 104 increasing “first-pass” rates and reducing the risk of hematoma formation and

105 other complications related to catheter insertion [4]. In this case, no ultrasound-  
106 guidance was used for double-catheter insertion. As a result, the blind puncture  
107 caused trauma on blood vessels leading to a hematoma and AVF formation. The  
108 existence of the AVF led to significant shunting of blood from the femoral artery  
109 to the venous system. The increased venous return eventually lead to the  
110 development of a high-output cardiac failure state, and the blood pressure in the  
111 lower vein system caused swelling and ulcers. As a result, the patient presented  
112 with swelling and infectious ulcers. Moreover, the failure of the open surgical  
113 repair and endovascular intervention made her refuse all subsequent surgical  
114 interventions, and for this reason the condition of her right leg worsened with  
115 widespread infection and sepsis.

116 Different treatment modalities are available for iatrogenic AVFs, including open  
117 surgical repair and percutaneous endovascular management. In this case, the  
118 patient's previous open repair surgery had failed and her medical state was serious.  
119 Endovascular aortic repair was therefore a safer option as it has a lower risk of  
120 surgical complications and mortality compared to open conventional repair.  
121 Furthermore, with the widespread infection, open surgery was not a suitable  
122 treatment method.

123 After inserting a cover stent via endovascular intervention, the angiography figures  
124 confirmed that the fistula was closed, and there was no blood flow from the  
125 femoral artery to the venous system. The condition of the right leg was notably  
126 improved in the follow up period.

127 An AVF following insertion of a double-catheter is rare but can cause serious  
128 problems. We would advocate for routine use of ultrasound-guided arterial  
129 punctures to minimise the risk of femoral AVF formation as well as other  
130 complications.

#### 131 **4. CONCLUSION**

132 Femoral venous catheterization is frequently used to obtain temporary access to  
133 circulation in patients requiring emergency HD. Iatrogenic AVFs are rare but  
134 occasionally fatal. It is recommended that ultrasound guidance be widely used for  
135 catheter insertion to avoid inadvertent arterial puncture. If iatrogenic AVFs are  
136 detected early and lesions are suitable for endovascular repair, cover-stent should  
137 be considered as an alternative treatment modality.

#### 138 **CONSENT AND ETHICAL APPROVAL**

139 As per university standard guidelines, participant consent and ethical approval has  
140 been collected and retained by the authors.

#### 141 **COMPETING INTERESTS**

142 Authors have declared that no competing interests exist.

#### 143 **REFERENCES**

- 144 1. Porter J, Al-Jarrah Q, Richardson S: **A case of femoral arteriovenous**  
145 **fistula causing high-output cardiac failure, originally misdiagnosed as chronic**  
146 **fatigue syndrome.** *Case reports in vascular medicine* 2014, **2014**:510429-510429.
- 147 2. Hüseyin S, Yüksel V, Güçlü O, Yılmaztepe M, Canbaz S: **A Rare Etiology**  
148 **of Heart Failure: Traumatic Arteriovenous Fistula Due to Stab Injury 17**  
149 **Years Ago.** *Balkan medical journal* 2015, **32**:309-311.
- 150 3. Thavarajan D, Bakran A: **Iatrogenic arteriovenous fistula in the groin**  
151 **presenting as cardiac failure.** *NDT plus* 2009, **2**:46-48.
- 152 4. **III. NKF-K/DOQI Clinical Practice Guidelines for Vascular Access:**  
153 **Update 2000.** *American Journal of Kidney Diseases* 2001, **37**:S137-S181.

154



UNDER PEER REVIEW